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Indian Medical Gazette 1906. 41.

22200060454

INDIAN MEDICAL GAZETTE Vol. 41

Original Articles.

MALARIAL FEVERS AMONG EUROPEANS IN CALCUTTA, AND THEIR DIFFERENTIATION FROM THE SEVEN-DAY INFLUENZA-LIKE FEVER.

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SOME four or five years ago it was pretty generally considered that we had but little to learn, at any rate, from a clinical point of view, about malarial fevers in India, both typical attacks of ague in the early stages of the disease and the characteristic features of "malarial cachexia" due to repeated attacks being only too familiar to us all, while no less an authority than Ronald Ross had endorsed my opinion that the dreaded kala-azar was but a manifestation of the same protean affection. The Malarial Commission of the Royal Society first threw doubt on this simple view by showing that malarial parasites were nearly always absent from cases of chronic fever with very large spleens in Calcutta, and that the "endemic index of malaria," or the percentage of healthy children showing malarial parasites in their blood, was nil in this city in spite of the great number of cases regarded as "malarial cachexia." Rapidly following on this came the startling announcement of the independent discovery by Leishman and Donovan of small protozoal parasites in the spleen in such cases, although the former was the first to recognise their importance. The discovery of the same parasites in kala-azar by Bentley and myself and the demonstration by Donovan in Madras and myself in Calcutta that a large majority of the fevers hitherto classed as "malarial cachexia" were in reality caused by the new parasite quickly followed,* and it now became evident that our former notions of malarial fevers as a class required to be carefully revised. Valuable light has been thrown on this subject by the reports of Captain S. P. James on malaria in India and on kala-azar, but for its more complete elucidation the careful clinical and microscopical study of a large number of consecutive fever cases in a well-equipped hospital extending over at least a year is necessary in order to allow a clear idea to be obtained of the prevalence and types of true malaria, and the points to be relied on in differentiating them from other fevers. From the statement of the Malarial Commission [1] that this disease does not arise in Calcutta owing to the absence of the kinds of anopheles which carry the infection, a statement which has since been disproved by Alcock and Adie,[2] and in consequence of the endemic index being nil, it might be thought that Calcutta is the last place for such an inquiry as I have just indicated, but that this is not the case will be evident from the fact that I have found malarial parasites in one hundred and seventy-three cases in the European General Hospital alone during the last fifteen months, many of which have, as a matter of fact, originated in Calcutta. As during this period blood slides of every case of fever admitted to the open wards of the hospital have been examined, and shorthand notes and four-hour temperature charts taken, and the period includes the height of the malarial season of two years. I think this series of 173 fevers presenting malarial parasites may be taken as a sufficient basis for a brief description of the disease as it occurs in Calcutta and its neighbourhood, and I propose in the present paper to write a short account of the different types of malaria based on this material; for if we can once get a clear idea of exactly what cases are malarial clinically, we shall be able to decide what cases are not malarial, and set to work as early as possible to ascertain what they really are instead of blindly returning nearly every case as "Intermittent fever" or "Remittent fever,"—the terms used in the official* nomenclature for malarial fevers,—and troubling no more about them. In a paper in the November number of this journal I described a common seven-day influenza-like fever which has been much confused with malaria, and I may say at once that the great majority of short intermittent or remittent fevers other than this examined by me during the last fifteen months have proved to be malarial in nature, although a few have been due to heatstroke or exposure to the sun, and a few more to true influenza.

VARIETIES OF MALARIA MET WITH AND THEIR SEASONABLE DISTRIBUTION.

There seems to be very general opinion that the vast majority of malarial cases met with in India are of the malignant tertian or tropical variety, but this is not borne out by my present observations, for out of a total of 173 cases in which malarial parasites were found during the last fifteen months 91 have been of the malignant tertian variety, and no less than 79 of benign tertians, and only on three quartans, so that the benign tertians were not much fewer than the malignant tertians, although quartans are quite rare among Europeans, although somewhat less so among natives at the Medical College Hospital.

The seasonal incidence of the two varieties is nearly but not quite similar and can be most simply illustrated by Table I.

TABLE I.—MONTHLY INCIDENCE OF DIFFERENT FORMS OF MALARIA.

	1904.				1905.											
	Sept. Half.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Malignant Tertian	7	14	15	10	3	0	0	1	1	0	7	1	3	4	16	11
Benign Tertian	10	7	10	4	4	3	1	2	4	4	5	4	7	4	7	3
Quartan	...	...	...	...	.....	.....	...	...	...	...	1	...	...	1	...	1

Owing to the small number of cases in some of the months Table II showing the incidence of each type for the four quarters of the year will better serve to bring out some points.

TABLE II.—QUARTERLY INCIDENCE OF MALARIAL FEVERS.

	4th Quar. 1904.	1st Quar. 1905.	2nd Quar.	3rd Quar.	4th Quar.
M. T.	39	3	2	11	31
B. T.	21	8	10	16	14

The main prevalence of both the common types of malaria is in the later part of the rainy season and during the period of drying up which follows the cessation of the monsoon, but this autumnal rise is much more marked in the case of the malignant tertian than in that of the benign tertian type, while it also occurs later in the year. Further, during the season of minimal prevalence in from January to June the decline is more complete in the case of the malignant tertian variety, which may be said to be almost absent during these months. On the other hand, the benign tertian autumnal rise is less marked, while a few cases are met with all through the minimal season during the first two quarters of the year. Moreover, the rainy-season rise is a more gradual one and takes place earlier than the main rise of the malignant tertian kind and also declines sooner, so that in September of each both years the benign tertian form predominated, while in November malignant tertians were much the more frequently met with. The greater

* I suggested the term "cachexial fever" for these cases, and as the Committee of the International Catalogue of Scientific Literature have adopted the term in the slightly different form of "cachectic fever," I propose to use the latter in future.

* [Officially used, but drawn up by the Royal College of Physicians, who alone are responsible for the nomenclature.—ED., *I. M. G.*]

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prevalence of benign tertians in the first two quarters appears to be due to the greater frequency of relapses in this form, for a larger number of patients returned with it than with the malignant tertian variety. The greater persistence of this type will also account for the earlier rise of the seasonal curve of benign tertians, for when suitable carriers of the infection begin to abound in the early part of the rainy season, there will be a larger number of relapsing cases from which they may become infected and so spread the disease. Possibly there may be some differences in the varieties of mosquitoes which carry the two varieties, but as far as I know there is no evidence on this point. The most marked prevalence of the malignant tertian type is certainly in the last quarter of the year when drying up of the rains is going on, while it was later in 1905 than in 1904, in correspondence with the late final cessation of the rains in the former year.

PLACE WHERE THE DISEASE WAS CONTRACTED.

It has already been mentioned that although many of the patients had undoubtedly contracted their malaria in Calcutta, yet a good number came from beyond the town. Table III shows the number of cases coming from different areas.

TABLE III.—PLACES FROM WHICH THE MALARIAL CASES CAME.

Calcutta (within municipal limits)		... 70
Suburbs of Calcutta	Garden Reach	... 15
	Tollygunge	... 5
Surrounding districts		... 23
Railway employees		... 24
Miscellaneous		... 17

With regard to the cases coming from Calcutta itself some may doubtless have contracted the disease elsewhere and suffered from a relapse while subsequently living in Calcutta, but the histories of a considerable number of them points very definitely to their having first got the disease while actually residing in the town. Among such cases are a number of sailors who had not previously suffered from malaria, but who contracted the disease within a few weeks of coming to this port in the malarial season, which will not be surprising to anyone who knows the state of Kidderpore docks and its surroundings. Again, several nurses of the General Hospital contracted the disease for the first time while living in the quarters within the hospital compound, and other similar undoubted cases of first infection by malaria in Calcutta might be given. Again the disease very often attacks persons from parts of Australia which are free from malaria, but who are residing in Garden Reach in connection with the trade of importing horses. Yet the examination of blood films from a large number of healthy children in various parts of Calcutta including both Kidderpore and Garden Reach made by Captain Megaw, I.M.S., and myself during the last two years, (details of which will be published elsewhere,) have confirmed the fact pointed out by the Malaria Commission that the so-called "endemic index of malaria" of Calcutta is nil, and that, too, in spite of our examinations having been made at the height of the malarial season in the month of November instead of in the hot weather or early rains as in the previous observations referred to. It is clear, then, that an "endemic index of malaria" of nil is not evidence that malaria is absent from a place, although doubtless it may mean that the place is not an extremely malarious one, although Garden Reach appears to be an exception even to this modified rule for the disease has been so rife among the police there as to call for special investigation last year, while in the present year (1905) only three out of eighteen police stationed there have escaped the disease. Caution must then evidently be exercised in accepting a negative "endemic index" as a certain indication of the absence of malaria from any given place.

HISTORY OF ONSET OF THE DISEASE.

Duration of the disease before admission.—As the disease which is most likely to be confused with malaria is the six or seven-day influenza-like fever I have recently described, (3) and which has a very definite course, the duration of the disease before admission is often of service in the differential diagnosis of the two fevers. Table IV gives the duration of fever before admission in each of the two common forms of malaria.

TABLE IV.—DURATION OF FEVER BEFORE ADMISSION.

	0 days.	1 day.	2 days.	3 days.	4 days.	5 days.	6 days.	7 days.	8-10 days.	11-20 days.	3-4 weeks.	1-2 months.	12 months.
Malignant Tertian	0	3	9	6	7	9	7	8	9	7	9	2	5
Benign Tertian ...	3	1	3	7	12	9	5	1	3	8	9	5	7
Total ...	3	4	12	13	19	18	12	9	12	15	18	7	12
					90						64		

It is evident from this table that while three-fifths of the patients came to hospital within a week of the commencement of the fever, yet two-fifths came in at a later date, which would in itself nearly absolutely exclude the seven-day fever in the case of the latter series. A larger proportion of the benign tertians came in with a history of having had fever for several weeks than was the case in the malignant tertian series, doubtless due to the somewhat milder nature of the benign type, causing it to be more frequently neglected for a time.

Rigors.—Ague, or an attack of shivering, is the most characteristic feature of malarial fevers, yet I know of no fever occurring in India in which it may not also occur at the onset, not excluding typhoid itself, while I have already pointed out that it is very commonly met with at the beginning of the seven-day influenza-like fever, (3) although it but rarely recurs in that disease. It is the frequent and regular repetition of the rigors which is the typical feature of malarial fevers, as will be evident from the following data of the cases in which this point was noted in my series of cases :—

TABLE V.—OCCURRENCE OF RIGORS.

	Malignant Tertians.	Benign Tertians.	Total.
Rigors noted to have been absent	7	4	11
Rigors present, but frequency not noted ...	28	29	57
Rigors occurring daily ...	19	20	39
Rigors occurring every other day	10	11	21

The time of day at which the rigors occur is also of importance, for I find that some of the older writers lay stress on the frequency with which the rise of temperature in malarial fevers occurs in the morning as a point of differentiation from some other fevers, which is borne out to a great extent by the following figures obtained from the present series of cases :—

TABLE VI.—TIME OF DAY AT WHICH THE RIGORS OCCURRED.

	Malignant Tertians.	Benign Tertians.	Total.
Rigors occurred in the forenoon	10	9	19
Rigors occurred in the afternoon	3	8	11
Rigors occurred in the evening or night ...	2	1	3

Further, an analysis of the times at which the rise of temperature occurred in cases showing a

complete paroxysm in hospital gives the following result:—

TABLE VII.—TIME OF RISE OF TEMPERATURE.

	Malignant Tertians.	Benign Tertians.	Total.
From 4 A.M. to 12 noon ...	17	15	32
From 12 noon to 8 P.M. ...	22	15	37
From 8 P.M. to 4 A.M. ...	5	5	10

We see from these data both rigors and the rise of temperature in malarial fevers does very frequently occur during the forenoon, but I find from the examination of a number of charts of cachectic fever due to the Leishman-Donovan bodies that a similar morning rise is very commonly seen in them as well as in malarial cases, so that this point is not of much diagnostic value in differentiating between these two commonly confused fevers It is, however, worthy of note that it is quite exceptional for the rise in malarial fevers to occur in the night or very early morning hours, and is then usually due to postponement of the paroxism after quinine has been given. On the other hand a rise of temperature not at all uncommonly takes place in cachectic fever at about 2 A.M., with or without the characteristic double remittent type, and I have several times been correctly led to suspect the presence of the more serious cachexial type of fever by observing this early morning rise, which is, in my experience, very rarely seen in other long remittent or continued fevers, which may be confused with this disease.

The duration of the attacks of shivering in malarial fevers is usually about half an hour, although they may occasionally last one hour or more, especially in the malignant tertian type

In no case did a double rise occur in one day, as I have shown often occurs in cachectic fever, although one or two patients stated they had two rigors in one day before admission, a conceivable occurrence as a result of a mixed infection.

Headache.—After rigors, headache was the symptom most commonly complained of in the history of the illness, it having been noted in rather more than half of the cases, while it was very seldom noted as having been absent. Occasionally it was described as being severe, but it was very variable in its position, and in these respects it differed markedly from the constant severe headache, almost invariable of the frontal in location, of the seven-day influenza-like fever. Headache was somewhat more frequently noted in malignant tertian than in the benign tertian variety, although it was severe in several of the latter type.

Pains in the body or limbs were also noted in a considerable number of the cases of malaria during the fever, but they were nothing like as severe and constantly met with as in the seven-day fever nor as persistent.

Sickness and Nausea.—On the other hand nausea and vomiting were much more frequently recorded in the malarial series than in the seven-day fever, for while it was only noted in the histories of four out of fifty-four cases of the latter disease, in the malarial series it was recorded in nearly half the cases, while in only four cases was it noted to be absent. Not infrequently the sickness is bilious in character, while in some cases in which actual vomiting had not occurred, marked nausea had been presented. A history of nausea and vomiting, then, is a point in favour of malaria as against the seven-day fever.

The Tongue.—Furring of the tongue is very frequently seen in malarial fevers, but it is commonly only of slight degree, in which it differs from the marked furring of typhoid and some other fevers Again, it very seldom indeed presents the furring in the centre only with red tip and edges and sometimes also the strawberry-like appearance, due to red papillæ appearing through the fur on the dorsum, which I have pointed out is very characteristic of the seven-day influenza-like type of fever; a point of the greatest practical importance in the clinical differentiation of these two short fevers.

The Pulse.—In my previous paper on the seven-day fever I have pointed out that a very marked feature of the affection is the great constancy with which a slow pulse accompanies a high rise of temperature. An examination of the records of a number of these cases shows that it is quite exceptional to get a pulse of 100 or more a minute, while in no case was the rate per minute as high as 120. Further, this feature is especially well marked during the terminal rise, during which it was never recorded as reaching as high as 100 per minute; a point of which is specially noteworthy as it is cases admitted during this terminal rise of temperature with a history of several days' fever commencing with a rigor, which are so liable to be mistaken for malarial fever. The pulse has not very frequently been recorded in my malarial series of cases, but Table VIII shows an analysis of those in which it has been noted.

TABLE VIII.—PULSE RATE IN MALARIAL FEVERS.

Pulse rate.	TEMPERATURE WHEN THE PULSE RATE WAS TAKEN. 100 to 102.	102 to 103F.	103 to 104F.	Over 104F.	Total.
Pulse under 100	7	3	1	2	13
100 to 109 ...	1	3	2	...	6
110 to 119 ..	..	...	3	1	4
120 to 129 ...	...	...	1	5	6
130 and over ...	...	1	1	5	7
Total ...	8	7	8	13	36

It appears from this table that when the temperature rises to 102 or over, the pulse is nearly always 100 or more a minute, while on only three occasions was a temperature of 103 or more accompanied by a pulse of under 100, and in one of these cases only a single malarial parasite was found, while the symptoms and temperature curve pointed to the presence of seven-day fever complicated by very slight degree of malaria. Further, in 16 out of 21 cases with a temperature of 103 and over, the pulse reached 110 or more per minute. The highest pulse rates of 130 and over occurred in benign tertian fevers with temperatures of 105 and upwards, but these do not resemble the seven-day fever cases in their temperature curve. It is clear from the above data that a rapid pulse is a very important point in favour of a diagnosis of malaria as against the seven-day fever, and one, moreover, which is readily available just when the information is most wanted, namely, during the actual paroxysm of fever.

PHYSICAL SIGNS OF ORGANIC CHANGES IN THE INTERNAL ORGANS.

The Spleen.—Enlargement of the spleen has always been looked on as one of the most characteristic features of malaria, but in view of the recent discovery that very great enlargement of that organ is frequently due to the Leishman-Donovan parasites, it will be of interest to note the frequency of different degrees of enlargement of the spleen observed in the present series of malarial cases in Europeans. The data are shown in Table IX. from which it will be observed that in 60 per cent. of the cases the spleen was sufficiently enlarged to be felt below the ribs, and that, too, in spite of the fact that three-fifths of the cases had suffered from fever for only from one to seven days before admission.

TABLE IX.—THE DEGREE OF ENLARGEMENT OF THE SPLEEN.

	Benign Tertians.	Malignant Tertians.	Total.	Per cent.
Not felt ..	24	35	59	40
Just felt ...	20	25	45	
1 to 2 inches below the ribs ...	7	7	14	60
3 to 4 inches below the ribs ..	8	6	14	
To or below the navel ...	1	6	7	

This very frequent and rapid enlargement of the spleen is a most important point in favour of a diagnosis of malaria as against the seven-day fever, for in only four out of 54 cases of the latter disease, in which the state of the spleen was recorded, was it noted to be enlarged, and then only to a very slight degree.

Again, it is a noteworthy fact that in nearly one-sixth of these malarial cases in Europeans the organ was enlarged to the considerable degree of extending three, four or more inches below the ribs, for among them the treatment of the disease is very seldom as neglected as it commonly is in native patients, while similar degrees of enlargement of the spleen are commonly met with in the earlier stages, and sometimes also in the latter stages, of cachectic fever due to the Leishman-Donovan parasites, which has been for so long confused with malaria. Most of these cases of more marked splenic enlargement in the present malarial series occurred among those who had suffered longest from the disease, while several of them had been more than once in hospital for fever, and malarial parasites had been found in their blood on each occasion. Moreover, many of them presented very considerable degrees of anæmia and some of them also much wasting, and so were typical of the condition always known as "malarial cachexia" and quite indistinguishable by a single clinical examination from many cases of the more serious cachectic fever produced by the Leishman-Donovan bodies. Strange to say several European children admitted in this condition, due to repeated attacks of typical malarial fever and showing the parasites of that disease, had been permitted to go without any treatment with quinine from one to three months, incredible as it may seem in the present day. In view of these cases is it any wonder that a cachectic condition with enlarged spleen due solely to malaria is so often seen in such malarial districts as Dinajpur, where until recently quinine was but very seldom taken by those inhabitants, who lived beyond the reach of the few scattered dispensaries? These facts should be carefully borne in mind as a check to the inevitable tendency which has arisen to deny the existence of a true malarial cachexia just because some of the cases previously classed under this term have been found to be due to a protozoal parasite quite distinct from those of malaria. It is beyond the scope of the present paper to go further into this subject here, but I may say that in my experience true malarial cachexia occurs more commonly in children than in adults and is attended by a greater degree of anæmia but less wasting than in cases of catchectic fever due to the new spleen parasite. Moreover, the two forms of cachexia can usually be readily differentiated by the simple blood test which I have described elsewhere (4), namely, that in true malarial cases the red and the white corpuscles are both reduced in about equal proportions, while in cachectic fever the white are diminished in much greater proportion than are the red. Other points of differentiation depending on the type of fever and the effects of treatment will be mentioned further on under other headings.

The Liver.—Some degree of enlargement of the liver was detected in 19 per cent. of the cases, but in only two of them did it reach to over two inches below the costal margin. On the other hand, I have noticed that a marked degree of enlargement of the liver is very common in cachexial fever, in which the organ not infrequently extends down to the navel, so that a considerable degree of liver enlargement is a point in favour of the diagnosis of the latter disease as aganist true malarial cachexia.

The Lungs.—These organs are remarkable free from affection in malarial fevers, slight cough being occasionally noted, while very exceptionally a few moist sounds may be heard.

The Heart.—In cases showing anæmia hæmic murmurs are commonly detected, but no other affection of this organ has been noted.

Anæmia.—This symptom has already been referred to under the heading of spleen, and its significance discussed.

Mortality.—Five deaths have occurred among 173 cases, four of which were malignant tertians, giving a mortality for this type of 4·4 per cent., and one among the benign tertians or a percentage of 1·26. Three of these deaths occurred within a few hours after admission in an unconscious condition, very numerous malarial parasites being present, actually outnumbering the red corpuscles in one very remarkable case. These all occurred during the regular malarial season from September to December, and it is at this season that it is so important to make a very early examination for malarial parasites in every case of fever with serious symptoms, for, owing to the great number of parasites present in these cases, they can be found very rapidly, while with the Leishman modification of Romanosky's stain, a specimen of the blood can be prepared for microscopical examination within five minutes. In these urgent cases quinine should be given hypodermically, or better still intravenously, at least ten grains of the soluble bi-hydrochlorate being used. In one case which I saw in consultation, plague had been diagnosed and quinine withheld for some days, although I found the blood to be swarming with malignant tertian malarial parasites, and hypodermic injections of the drug were too late to recover the patient from the condition of coma into which he had fallen. When so many deaths occur from malaria among Europeans, who are so fully aware of the value of quinine in the treatment of fevers, is it not certain that the mortality will be much greater among natives beyond the reach of efficient treatment in their very malarious villages; or is it surprising that as a result of my inquiry into the causes of death in the Dinajpur district (5) that I should have found that nearly one-third of the total were due to malaria and cachectic fevers, and that three-quarters of the deaths from acute malaria occurred in children during the autumn malarial season?

THE TEMPERATURE CURVE IN DIFFERENT TYPES OF MALARIA.

I next come to the very important point of the constancy or otherwise of the types of temperature curves met with in malarial fevers, for Italian writers have long ago carefully described the temperature curves of the different forms of malaria, and find them to be sufficiently constant to be of the greatest diagnostic value. In India the confusion of malarial with other fever has lead to this point being greatly obscured, while the usual practice in all but a few of the larger hospitals of the temperature being only recorded twice a day, namely in the morning and evening, has deprived the charts of their most essential features. Captain S. P. James, I.M.S., has very recently done good service in calling renewed attention to the value of the temperature curve in the diagnosis of malignant tertian malarial fever, while the conclusions I am about to set forth based on a study of four-hour temperature charts of 173 consecutive cases obtained during the last fifteen months have been reached quite independent of his paper.

BENIGN TERTIAN MALARIA.

It will be convenient to commence with the more simple benign tertian form. As every case was put on quinine as soon as a blood film had been made, and I shall show presently that the average duration of the fever in this type after the administration of quinine was less than two days, a large proportion of the cases showed only a single paroxysm of fever either wholly or in part, so that only a comparatively small number showed two or more rises of temperature necessary to determine if the fever was of the double or single tertian type. The examination of the blood films, however, showed that in the great majority of the cases, both the small first-day ring forms and the much larger second-day forms were both present at the same time, proving a double infection.

Further, among those cases in which the fever persisted for two days or more after admission, four-fifths showed the daily rise of a double infection shown in Chart I, and only one-fifth the typical tertian type with a fever only on alternate days as in Chart III, while in a few more a typical tertian type of Chart II was seen. It is probably owing to this fact that benign tertians have been thought to be comparatively rare in Calcutta instead of constituting nearly one half of the malarial cases. There is, however, a very simple clinical point by which benign tertians can nearly always be differentiated from malignant tertians, and that is by the much shorter duration of the paroxysms in the former than in the more severe malignant form. The characteristic feature of the benign tertian chart is the rapid rise, often to a very high degree such as 105° or even 106° F., followed by an almost equally rapid fall, so that the whole paroxysm is completed in from 12 to 20 hours in three-fourths of the cases, the temperature commonly declining to below normal during the defervescence of the fever as shown in Chart I. On the other hand in the malignant tertian variety it is the rule for the rise of temperature to last from 24 to 40 hours, thus extending into the second day as shown in Charts V and VI to be followed by a second rise with but a short interval of partial or complete cessation of the fever. That this point will clearly differentiate the great majority of cases of these two forms of malaria will be evident from a study of Tables X and XI in which the types of temperature curve and the duration in hours of the fever are tabulated. Those cases in which the temperature did not fall to normal between the paroxysms are classed as remittents, a type which is quite uncommon in benign tertians and usually accompanied by very numerous parasites. A few cases have been also classed as "irregular" in type owing mainly to the temperature after falling rapidly to several degrees from its highest point then remaining for some hours slightly raised before finally reaching the normal as shown in Chart IV, these cases nearly always showing very numerous parasites in different stages of development, which accounts for the prolongation of the fever curve. Most of the cases in which a benign tertian paroxysm lasted for over 24 hours belonged to this class.

TABLE X.—TYPES AND DURATION OF FEVER IN BENIGN TERTIANS.

	4-12 hours.	12-20 hours.	20-24 hours.	Over 24 hours.	Total.
Incomplete paroxysm	...	...	...	...	20
Single paroxysm ...	4	4	1	...	9
Remittent Fever ...	...	2	...	1	3
Daily Int. ...	5	10	...	1	16
Tertian type ...	1	2	1	...	4
Irregular type ...	...	1	...	5	6
Total ...	10	19	2	7	38

TABLE XI.—TYPES AND DURATION OF FEVER IN MALIGNANT TERTIANS.

		4-12 hours.	12-20 hours.	20-24 hours.	Over 24 hours.	Total.
Incomplete paroxysm		...	...	..	...	17
Typical curve	Int.	1	1	3	19	24
	Rem.	...	2	...	5	7
Daily Int.		1	2	...	...	3
Low Int.		...	...	...	...	10
Abortive type ...		1	5	...	1	7
Total ...		3	10	3	25	...

TEMPERATURE CURVE IN MALIGNANT TERTIANS.

A four-hour chart of a malignant tertian case is even more characteristic than that of the benign tertian, for the usual single daily rise of the latter may frequently be simulated by other fevers, although in my experience a rigor preceding a rapid rise to about 105°F. followed by nearly as rapid a fall, is almost invariably produced by benign tertian parasites, especially if the rigor occurs in the forenoon. The main features of the malignant tertian curve are a rapid rise to 103 or 104, preceded by a rigor, often occurring in the forenoon, followed usually by a slight fall of a degree or two, sometimes with a small succeeding rise as in Chart VI and then, after persisting at a high point for some twelve or more hours, a fall, at first rapid, but becoming slower as the curve descends to 100 or so in remittent cases or to normal in the intermittent form, the whole rise having occupied from 24 to 36 hours as a rule, and only rarely being less than the shorter mentioned period. I know of no other fever presenting a series of such rises, each extending over twenty-four hours or more, and recurring every second day. Under the influence of quinine each rise becomes both lower in its curve and of shorter duration until it may be only a short rise to 101 or so, this feature being well shown in Chart V. Occasionally slight variations of the typical curve may be seen. Thus in three cases a daily rise of temperature occurred of short duration (see Chart, VII) these cases resembling those classed by Marchiafava and Bignami as "Estival quotidian," but I could find no difference between the parasites in such cases and those of the ordinary malignant tertian type, nor is the short duration of the paroxysm due to mildness of the infection, as in one case the parasites were extremely numerous, while in another there were large numbers of crescents and the case terminated fatally.

Low Intermittent Type.—Another occasional temperature curve is one in which the temperature rises only to about 100° or 101° F. each day, of which I have met with seven cases, in four of which crescents were present, while in none of them were the parasites numerous, so they appear to be abortive rises in a mild but persistent infection. Chart VIII illustrates this type.

Irregular types which do not fall under any of the above headings are less common in this form of malaria than in the benign tertians, and, like the latter, consist in a prolongation of the paroxysm accompanied by very numerous parasites. (Chart IX.)

Abortive Paroxysms.—A few cases of malignant tertian fever were admitted during one rise of temperature, of which only an incomplete curve was therefore obtained, and on the second day a late or postponed paroxysm of comparatively low type and of short duration, usually 16 to 20 hours, occurred, which somewhat resemble the benign tertian type, but showing not very numerous malignant tertian parasites. The second rise in Chart VI illustrates this type of fever, which is not difficult to recognise if its occasional occurrence is borne in mind.

Quartans.—In none of the three admissions for quartan fever was a typical chart seen, daily rises for two days only occurring due to double infection (see Chart X).

Remittent Malarial Fever.—One of the points which I was most anxious to clear up by the present investigation was the frequency with which malaria produced a remittent type of fever and their degree and duration. It will be seen from Tables X and XI that in only three benign tertians and seven malignant tertians did remittent fever occur, and Charts XI and XII show the longest of these cases, from which it appears that any remittent fever of over fours days' duration is almost certainly not malarial in nature—a fact of the utmost interest and importance.

I have now described the characters of the temperature curves seen in four-hour charts met with in this considerable series of malarial fevers, and it will be clear that they agree very closely indeed with the types recorded by European writers, so that we may I think, safely conclude that malarial fevers in Calcutta do not differ in any essential respect from those of Italy and elsewhere. I would go further and maintain that any fever which does not correspond with one of these types in its main features should be regarded as almost certainly not malarial in character, and worthy of closer investigation, among which we may place the seven-day influenza-like fever I have recently described. Once more, by close attention to the temperature curve of a four-hour chart we may safely diagnose malarial fevers in a large proportion of cases and thus lessen materially the number in which a blood examination is necessary in ordinary clinical work

THE DURATION OF THE FEVER UNDER TREATMENT AND THE QUININE TEST FOR MALARIA.

I now come to the still more important fact both from the practical point of view of treatment and in the differentiation of malarial from other fevers met with in the tropics. For long I agreed with the general view that in India there was a type of malarial remittent fever which might last for some time in spite of treatment with quinine by the mouth and lead to a cachectic condition with enlarged spleen. I was strengthened in this belief by frequently finding malarial parasites in all stages of kala-azar in Assam, (7) a fact which is now explained by my having found on returning in 1904 to the very tea gardens where most of my cases had been examined, that the endemic index for malaria in those places gave the extremely high figure of 80 per cent. of infection among the healthy children, so that nearly every inhabitant suffered repeatedly from malaria. More recently Captain James has stated (8) that he found a similarly high endemic index earlier in the malarial season than I made my examinations, so that it is clear that this very high degree of malaria persists for several months in those places and the frequent presence of parasite in kala-azar cases is easily explained. Then the Malaria Commission (1) laid great stress on the value of an increase of the proportion of the large mononuclear leucocytes as evidence of malarial infection in the absence of malarial parasites, and following up this mode of investigation I did leucocyte counts and serum tests in all the long continued and remittent fevers at the General and Medical College Hospitals for a year and-a-half, with the result that I found that practically every case which did not give the reaction for typhoid showed a large mononuclear increase which we had been told was diagnostic of malaria, (8) while a series of bloods obtained from kala-azar cases, kindly obtained for me by Dr. Dodds Price, showed the same blood change, and I advanced this fact as an argument that these cases were true malarial cachexia (9). The subsequent discovery of the Leishman-Donovan parasites in these cases proved that the large mononuclear increase is not found solely in malarial fevers but also in those accompanied by the new parasite, and thus made it necessary to reinvestigate the possibility of malaria producing remittent fevers of any long duration under treatment. In my earlier General Hospital work I had not been able to get blood films before the administration of quinine, so that the failure to find malarial parasites was not sufficient evidence of the absence of malaria. In order to get over this difficulty I arranged, through the great kindness of the Resident Surgeons of the General Hospital (Captains C. A. Lane, R. P. Wilson and J. G. P. Murray, I.M.S., to whom I desire to express my great obligation) to examine slides from every case before any quinine had been given. In Table XII the duration after the administration of quinine of the cases in which malarial parasites were found during the last fifteen months is given, being classed according to both the type of fever and the amount of quinine given per day.

TABLE XII.—DURATION OF FEVER AFTER TAKING QUININE.

	Malignant tertians. Amount of quinine daily.			Benign tertians. Amount of quinine daily.			
	60 grains.	30 to 40.	20 or less.	60 grains.	30 to 40.	20 or less.	Total.
No fever ...	0	3	3	4	4	3	17
1 day ...	15	6	2	13	8	5	49
2 days ...	10	6	4	10	7	2	39
3 days ...	10	8	6	5	3	1	33
4 days ...	6	1	1	2	0	0	10
5 days ...	0	2	0	0	0	0	2
6 days ...	2	0	1	0	0	0	3
Average duration ...	2·35	2·12	2·2	1·65	1·33	1·0	

The results are most striking, for in very few cases did the fever last more than three days under quinine treatment; in only five cases did it run over four days, while in no single case did it continue for more than six days. It will also be seen on reference to Table X and XI that very few of the cases showed the remittent type of fever even for these short periods, while in only one of these did the temperature remain continually above normal for as long as four days after quinine was given, the remittent type persisting for only three days or less in the remaining cases. It is clear, then, that in Calcutta malaria seldom or never produces a remittent type of fever which persists for more than a very few days under quinine treatment, and that in all cases where continued or remittent fever lasts longer than that time under such treatment some other cause than malaria must be sought for to account for it.

What, then, are the cases of remittent fever other than typhoid which have hitherto been mistaken for malaria by myself and others? That is a question which I am not at present able to fully answer, but I may say that a few of them have been the continued type of seven-day fever, a very considerable proportion of them are early stages of cachectic fever, for I find by examination of the records of the General Hospital for the last three years that some of the cases which I had classed as malarial remittents have subsequently been readmitted in an advanced stage of cachectic fever and have died of this disease. The further consideration of this class of cases must be reserved for a future occasion, when I have had time to work out the vast amount of material I have accumulated, when I hope to be able to more clearly differentiate the early stages of this very important and difficult fever, which is only too common among the class of Europeans admitted to the General Hospital, and which causes a far higher death-rate among them than either malarial or typhoid fevers, or in some years even than both put together.

The Dosage of Quinine in the Treatment of Malaria.—In Table XII I have also given the results of an analysis of the duration of malarial fevers of each variety under treatment with different doses of quinine. As in certain of the wards the routine dose was 30 grains a day, while in others it was double that amount, the data afford fair grounds for the comparison of the effects of these different quantities of the drug. In only a few cases 40 grains was given a day, and in a few more only 20 or less was ordered, most of the latter being children. The result is very instructive, for they appear to show that 30 to 40 grains a day (always given in ten-grain doses more or less frequently repeated in the twenty-four hours) were quite as effective as 60 grains, so that the latter amount seems to be unnecessarily large, while it has the disadvantage of often causing much buzzing in the ears and deafness. Ten grains three or four times a day, therefore, should be given as a rule in malarial, the urgent cases of very severe infection being treated by the hypodermic or intravenous methods, although these are only very occasionally necessary.

The Quinine Test for Malarial—The fact that none of these 173 consecutive malarial fevers lasted more than six days under quinine treatment, which in no case did the fever fail to show signs of becoming less severe within four days, is the most important lesson to be derived from the present investigation, for if it is found to be equally true of other parts of India, as I believe it is, then the effect of the failure of quinine to reduce the fever within the short period mentioned may be taken as conclusive evidence that the case is not one of malaria, and some other cause must be at once sought for, and the case on no account returned as malarial. If this simple rule is regularly observed, and all non-malarial cases carefully investigated, much light will soon be thrown on Indian fevers and some system of nomenclature may shortly be evolved which will allow of an approximately correct classification of Indian fevers, for the official returns of fevers in even the best civil

and military hospitals of India at the present time are very far indeed from being accurate.

The converse, of course, will not hold good, for short fevers of a non-malarial nature may quickly cease while quinine is being given, such as cases of the seven-day fever admitted during the terminal rise, and those possibly due to exposure to the sun or over-exertion in the unacclimatised. The typical course of the seven-day fever when admitted early in the disease is quite unaffected by quinine, and they terminate just as rapidly with no quinine at all.

In cases of true malarial cachexia with marked enlargement of the spleen, anæmia and wasting the actual paroxysms of fever are cut short just as quickly by quinine as in recent infections, several cases of this kind, in which the fever had been allowed to go on for several weeks or months without a single grain of quinine being given, yielded in from one to three days after being put under its influence on admission to hospital. This fact has also been observed independently by Captain James, and is of the utmost practical importance in differentiating between true chronic malaria and cachectic fever due to the Leishman-Donovan parasites in which quinine has no such immediate effect in absolutely stopping the fever, although it often reduces it to a lower degree.

Dosage of Quinine during Convalescence.—Although quinine has such a marvellous effect in stopping the fever of malaria, yet it must not be thought that this means that the fever is cured, for nothing is more marked than the inveterate tendency of malaria to relapse, even after long intervals, and that too in cases where the drug had been continued for some time after the cessation of the ague. For this reason it is advisable to continue giving 30 grains a day for several days after the temperature falls, and then to give ten grains every morning for another two or three weeks, after which the usual prophylactic doses of ten grains twice a week, should be continued for several months. Where prevention is so easy and assured as in this case it certainly should not be omitted, especially in children in whom anæmia is so rapidly produced by repeated attacks of malaria. Too small a prophylactic dose should not be given in the case of young children as I have known a severe attack of malignant tertian malaria to arise in a child of eight years, who was taking five grains of quinine twice a week.

The Numbers of Parasites Found.—In order to gain some idea of the time usually required to find the parasites in malarial fevers, I have classed the results of my examinations under the headings shown in Table XIII. "Very numerous" means that the parasites were found immediately, being usually present in every field of the microscope. "Numerous" means that they were found after a very short search of a minute or less. "Rather few" means that some search was necessary to detect them, but they were found within five minutes. "Very few" means that only a very small number were found after a long search of from five to ten minutes, so that they might easily have been overlooked without considerable experience, while in some of them only one or two parasites were found, the detection of which might be considered in some degree a matter of chance. The figures in brackets signify the number of patients which were known to have taken quinine before admission, from which it will be seen that seven out of ten malignant tertians and two out of six benign ones showing only a very few parasites had been dosed with quinine before the blood slide was taken, while in only one of the latter was it noted that no quinine had been taken before admission, while another of them had no fever after admission to hospital.

Table XIII.—Number of Parasites Found.

	Malignant Tertians.		Benign Tertians.		Total.	Per cent.
Very numerous	18	(1)	30	(4)	48	77·5
Numerous ...	48	(7)	28	(3)	76	
Rather few ...	8	(4)	12	(0)	20	12·5
Very few ...	10	(7)	6	(2)	16	10·0
Crescents only	4	(1)				

It will be seen from this table that in 77·5 per cent. of the cases the parasites were found within about one minute, and in 12·5 per cent. more within five minutes, while in only 10 per cent. were they very few in number necessitating a more prolonged search, and in more than half these quinine had been taken before the blood examination. It is clear, then, that in the very great majority of cases (90 per cent.) with malarial parasites in the blood they can be detected within ten minutes,—including both the staining and microscopical examination of the slides,—while the average time taken will be considerably less, especially if several slides are stained at the same time. Moreover, the parasites may not infrequently be readily found even after quinine has been taken.

The more difficult question remains as to how many cases of true malarial fever failed to show the parasites in the peripheral blood. An examination of the notes and charts of the short fevers in which no malarial parasites were found reveals some which were undoubtedly malarial, especially among those which had previously taken quinine. It is difficult to state the exact number of each case, but the figure works out at about 20 in the last fifteen months, or one-tenth of the whole malarial series including these. From this it would appear that parasites may be found in about nine-tenths of true malarial fevers on admission to hospital, and that too in Europeans, who are specially liable to have taken quinine before admission, so that in the absence of parasites a diagnosis of malaria should not be made without a very clear history of repeated ague or a very typical temperature curve. In this connection it should be borne in mind that at the very outset of a first infection malarial parasites may be absent for a day or two, as in case of the experimental infections in London through mosquitoes fed in Italy, but in ordinary practice it is not advisable to withhold quinine until the nature of the disease has been microscopically verified, while there may be some danger in doing so, for patients showing not very numerous parasites may sometimes rapidly pass into a comatose condition, out of which it may be impossible to recover them with even the most heroic doses of quinine. When numerous parasites are found in every field of the microscope, I think at least ten grains of quinine should be given intravenously at once without waiting for cerebral symptoms to set in, for I have never seen an adult recover after coma had appeared.

The Differential Leucocyte Count in Malaria.

In view of the fact just recorded that malarial parasites can be readily found in some nine-tenths of true malarial fevers, the somewhat laborious method of estimating the proportion of the different kinds of leucocytes as an aid to the diagnosis of this disease would not be very often required even if it were quite reliable. In order to estimate its value in the differentiation of the short intermittent fevers of Calcutta, I have made such counts in some 600 cases during the last year at the cost of an immense amount of time, but the results have been very disappointing. Without going into minute details of the figures it will suffice to say that in the first place, owing to the absence of any but a slight degree of the typical large mononuclear increase of malaria during the height of the fever, this sign is frequently absent, especially in the case of malignant tertians on account of the prolonged nature of the rise of temperature in them; and in the second place the same change is frequently met with in all stages of cachectic fever, and also sometimes in the seven day-fever, as I have already pointed out in my description of that disease. For these reasons the test is of little value in differentiating the short intermittent and remittent fevers of Calcutta, although its value in separating typhoid from other long remittents (chiefly the early stages of cachectic fever) which I have previously pointed out ([8]) still holds good. Where I have found it of

some use is that in a preliminary observation of a blood film any marked large mononuclear increase may be detected by a rapid survey of the edge with an one-eighth inch lens, which has frequently led me to suspect the presence of malaria, which was soon confirmed by a further search for parasites, the benign tertian forms being commonly seen with the same lens along the edge of the films, although an oil emersion is necessary for finding the smaller malignant tertian forms, which are more uniformly distributed over the film than are the large benign tertian forms.

DIFFERENTIAL DIAGNOSIS OF MALARIAL FEVERS

Having now described the symptoms and course of malarial fevers and shown that when treated efficiently with quinine they run a very short course of usually one to four days with characteristic temperature curves, it remains to note the chief points in the differential diagnosis between malaria and those fevers which are most frequently confused with it.

1. *Cachectic Fever and Kala-azar.*—Now that it is clearly seen from the large number of consecutive malarial cases analysed in this paper that malaria does not produce a fever of long duration in spite of the free use of quinine, nothing is easier than to differentiate between an active case of cachectic fever due to the new spleen parasite and one of true malarial cachexia, for the latter will yield at once to quinine, while in the former the fever will continue in spite of it, although frequently at a lower level. On the other hand, cases of enlarged spleen and wasting without actual fever at the time cannot be clinically distinguished in many cases without a microscopical examination of the blood, when the presence of a great relative reduction of the white corpuscles will be a strong indication of the more serious cachexial fever being present as I have elsewhere shown (4). The clinical differentiation between cachectic fever in its earliar stages and other long fevers such as typhoid and Malta fever, is a much more difficult question which I must leave for future consideration, although the leucocyte decrease just mentioned is of great value here also.

2. *From the seven-day fever.*—The frequency with which these cases have been returned as malaria at the General Hospital for a number of years, as I shall show presently, indicates the difficulty in separating them, especially in cases admitted during the terminal rise of temperature, so it may be well to recapitulate the main points of value in their differentiation. Firstly, the history of the illness will be of seven days or more fever in nearly half the malarial cases, which will practically exclude the seven-day fever. Rigors usually will have occurred repeatedly either every day or every other day in malaria, while they rarely occur more than once at the onset of the fever in the seven-day cases. Headache is much more severe and almost always frontal in type, often with pain in the back of the eyes in the seven-day type, while the pains in the back, limbs and joints are much more severe and continued in this fever than in malaria. Again, the furring of the tongue in the centre only with red raw edges, and sometimes red points on the dorsum, is almost pathognomonic of seven-day fever as against malaria in which slight uniform furring is the rule—a point of the greatest value. The pulse, again, is very rarely above 100 in the seven-day fever, and never up to that point during the high terminal rise in my experience, while in malaria during fever up to 103°F to 104°F or over the pulse is almost always above 100° a minute and usually 110° or more. Enlargement of the spleen is rare and very slight in the seven-day fever, but was present in sixty per cent. of my malarial series in spite of the fever having lasted only a week or less in three-fifths of them. The mottled rash occasionally seen in the seven-day fever has not been observed in any of the malarial series. These points will almost always allow of the diagnosis being made, while the absence of malarial parasites in a patient who has not taken quinine will also aid in excluding malaria. The subsequent course of the disease in seven-day cases which are admitted early will confirm the diagnosis for the gradual remission of the temperature followed by a final high rise and cessation on the sixth or seventh day, is quite unlike any malarial chart.

THE SEASONAL INCIDENCE OF SEVEN-DAY FEVER AND OF MALARIA.

In my recent account of the seven-day influenza-like fever I was unable to deal with its seasonal incidence as the disease was still very prevalent, but subsequently it began to decline rapidly just at the time that malarial fevers were increasing, the two diseases thus presenting different seasonal curves, although taken together they formed a continuous curve extending over the rainy season and the time of drying up which follows it. As in former years I had met with a few cases presenting the typical charts of the seven-day fever, and the points of differentiation above mentioned allow of a correct diagnosis of the malarial and seven-day fevers respectively being made by means of an examination of the notes and charts of the General Hospital records; with the kind permission of the Surgeon-Superintendent I have recently been through all the notes of the open wards of this large hospital for one year and nine months previous to the fifteen months during which I have been examining blood slides of every case, and thus been able to show in the accompanying chart the seasonal incidence of the two diseases month by month for the last three years. A few doubtful cases were omitted, so the numbers of each disease is somewhat less than they should be, but the curve may be taken to be substantially accurate for the first 21 months, and absolutely so during the last year and a quarter. The upper continued curve shows the incidence of malaria and the lower one that of seven-day fever, while the interrupted line indicates the combination of the figures of both diseases.

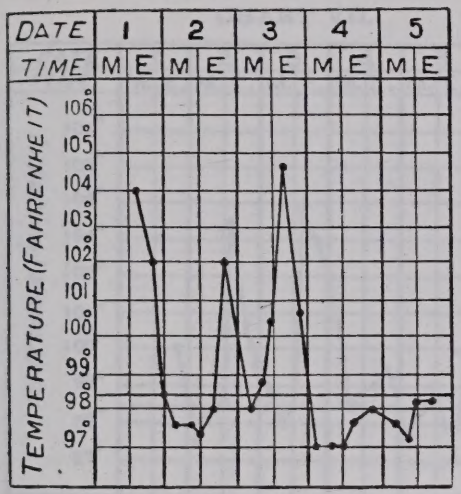
Taking first the malarial curve, we find the maximum prevalence of the disease occurring in November of each year, being also usually high in October and sometimes also in September, as in 1904, a year of special malarial intensity. During December and January the curve rapidly falls to reach its minimum from February to April, after which there is a slight and variable increase extending up to the beginning of the main rise at the end of the rainy season. Several years ago I pointed out that the main breeding ground of the malaria-carrying anopheles is the *kutcha* roadside drains and that the amount of malaria is less in those years when steady rains flush them regularly, while it is at the end of the rains when the water in these drains and in other collections of water are drying up that malaria is most prevalent as the anopheles can then breed undisturbed. I also showed that there is a rapid fall of the malaria when the minimum temperature falls to 60° F. or lower, due to this temperature being too low to allow of the malarial parasites developing in the mosquitoes, so that new infections become much less during December, and during the next few months such few cases of malaria as occur are almost, if not entirely, relapses. When it warms up again and rain storms refill the pools in the hot weather some increase of these fevers takes place. It will be seen that in this way the malarial curve is readily explained on the mosquito theory.

Turning next to the curve of the seven-day fever we find a very different incidence of the disease, for in both 1903 and 1904, years of ordinary prevalence of the disease, the curve rises abruptly to its maximum in the month of July, that is, in the early part of the rainy season, and falls nearly as rapidly during August and September just before the main malarial rise. During the last year the disease was unusually prevalent, and the curve both rose earlier, namely, in May and June, and continued later reaching its maximum in September,

MALARIAL FEVERS AMONG EUROPEANS IN CALCUTTA, AND THEIR DIFFERENTIATION FROM THE SEVEN-DAY INFLUENZA-LIKE FEVER.

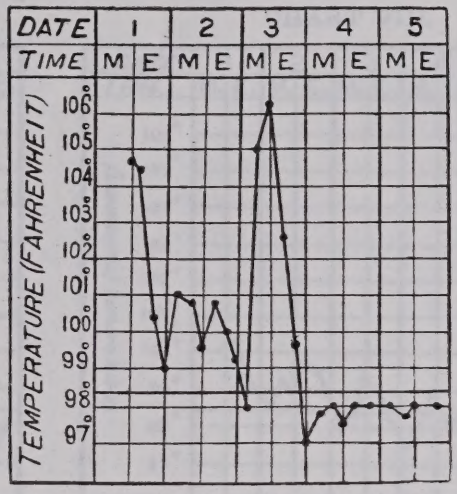
By LEONARD ROGERS, M.D., F.R.C.P., I.M.S.

CHART I.



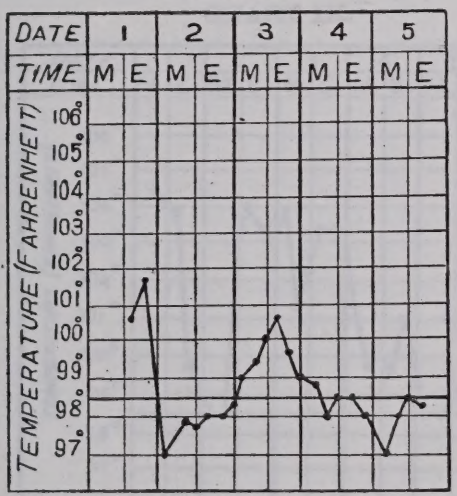
BENIGN TERTIAN.—Double Infection.

CHART II.



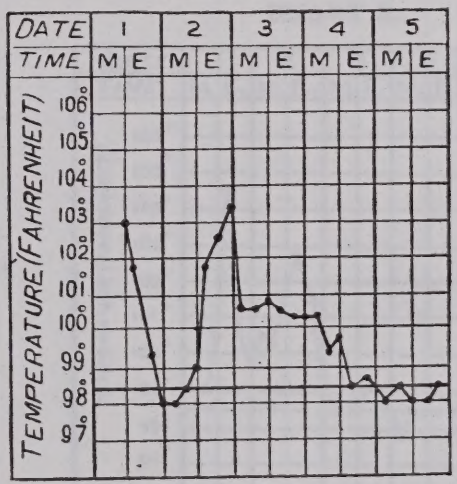
BENIGN TERTIAN.—Unequal Double Infection.

CHART III.



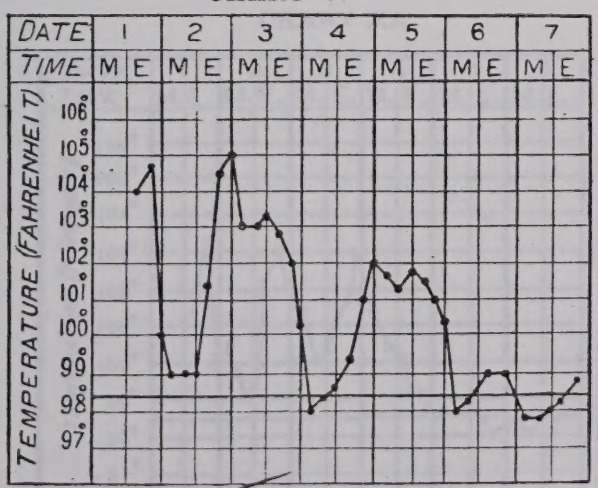
BENIGN TERTIAN.—Single Infection.

CHART IV.



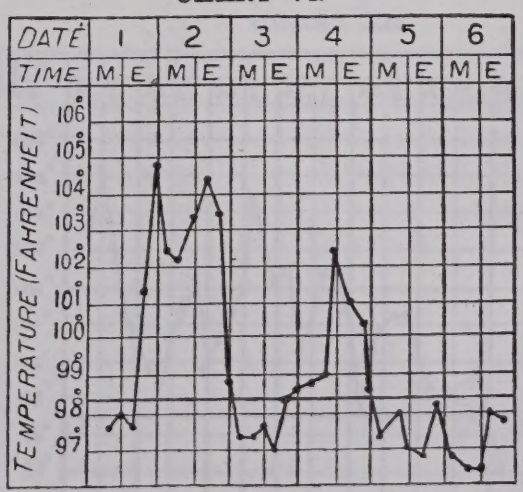
BENIGN TERTIAN.—Irregular Prolonged Paroxysm.

CHART V.

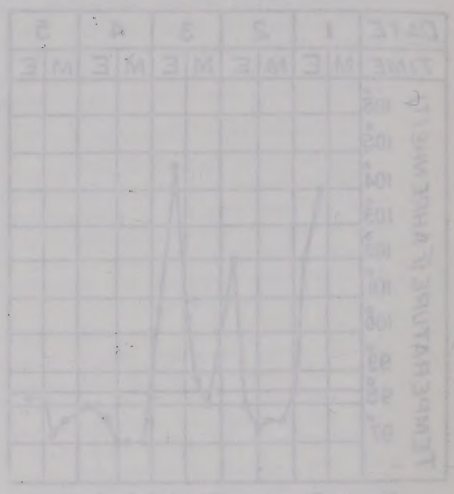


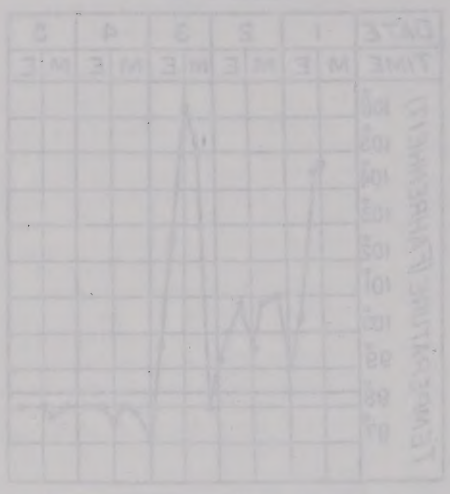
MALIGNANT TERTIAN.—Typical Curve.

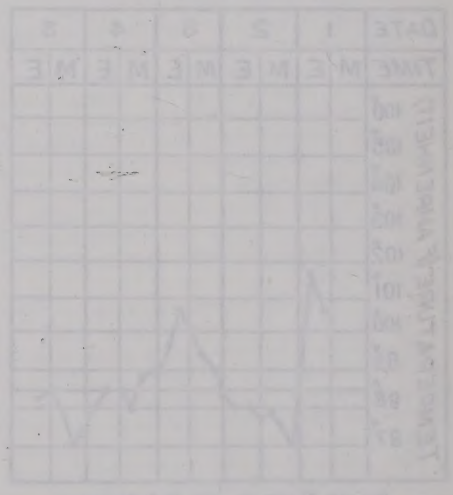
CHART VI.

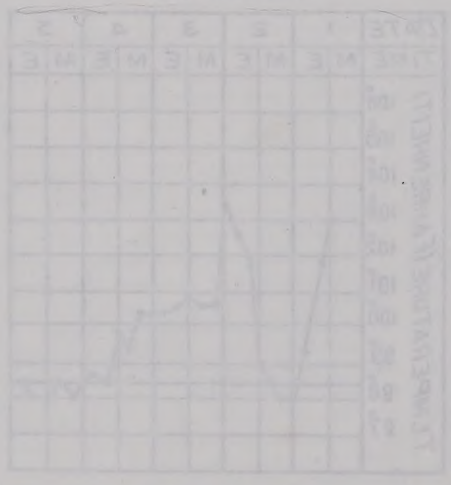


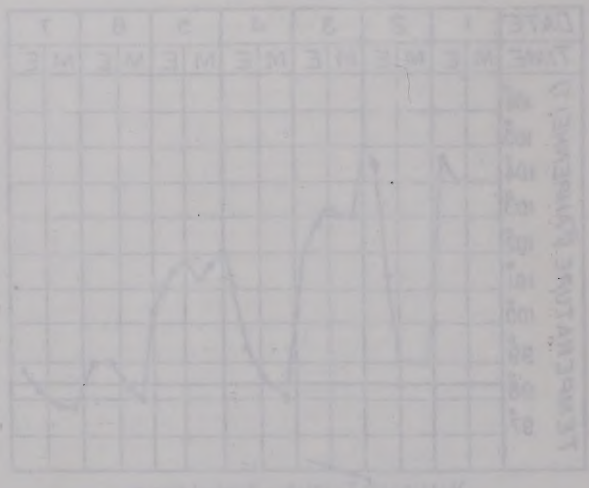
MALIGNANT TERTIAN.—Second rise of Abortive type.

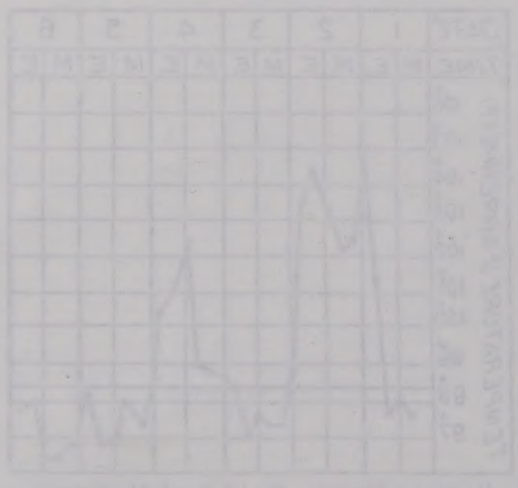








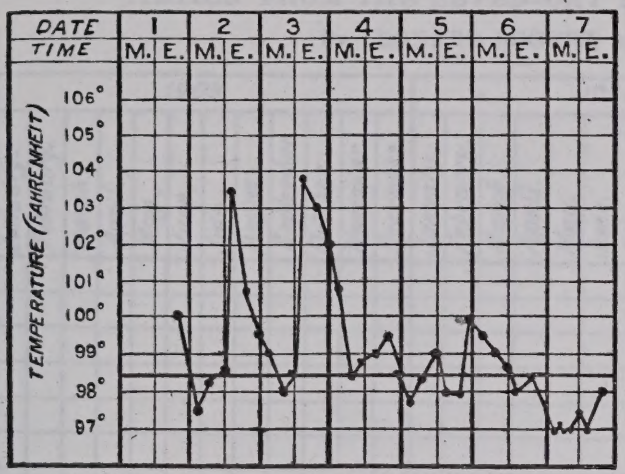




MALARIAL FEVERS AMONG EUROPEANS IN CALCUTTA, AND THEIR DIFFERENTIATION FROM THE SEVEN-DAY INFLUENZA-LIKE FEVER.

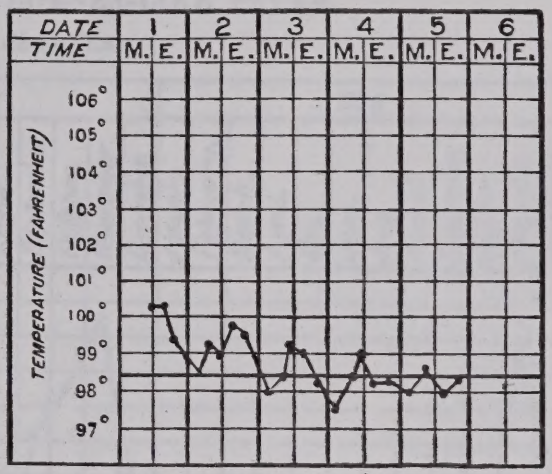
By LEONARD ROGERS, M.D., F.R.C.P., I.M.S.

CHART VII.



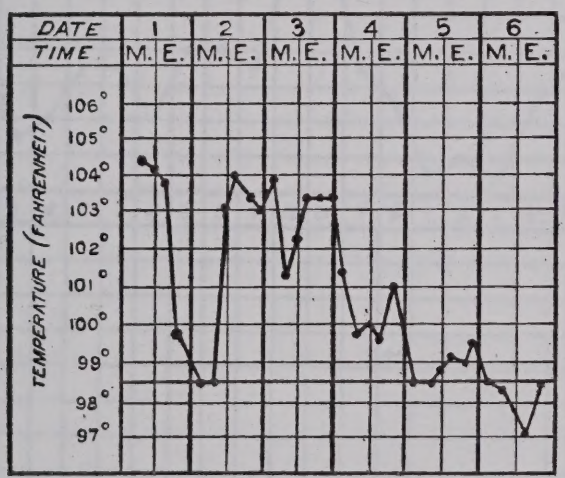
MALIGNANT TERTIAN.—Daily rise.

CHART VIII.



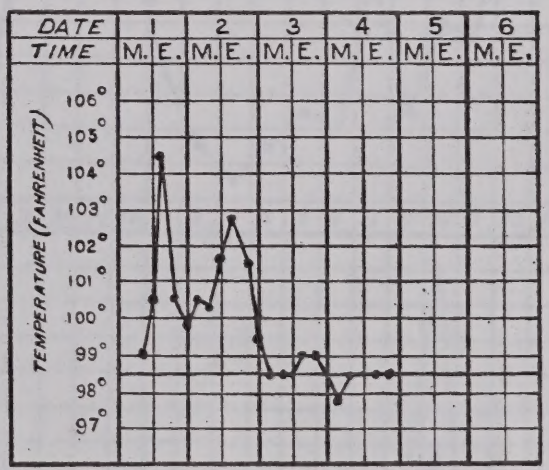
MALIGNANT TERTIAN.—Low Intermittent type.

CHART IX.



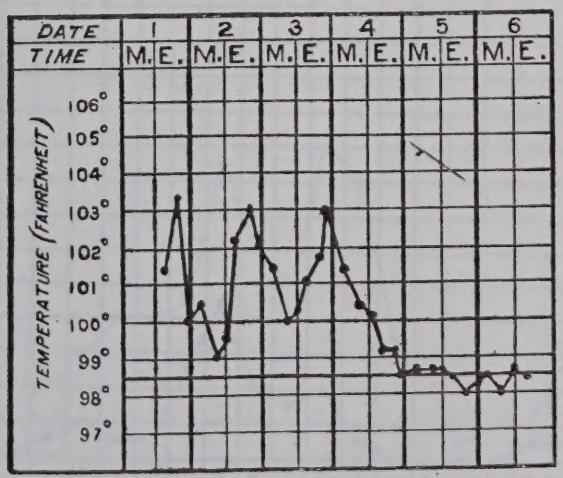
MALIGNANT TERTIAN.—Irregular Prolonged Paroxysm.

CHART X.



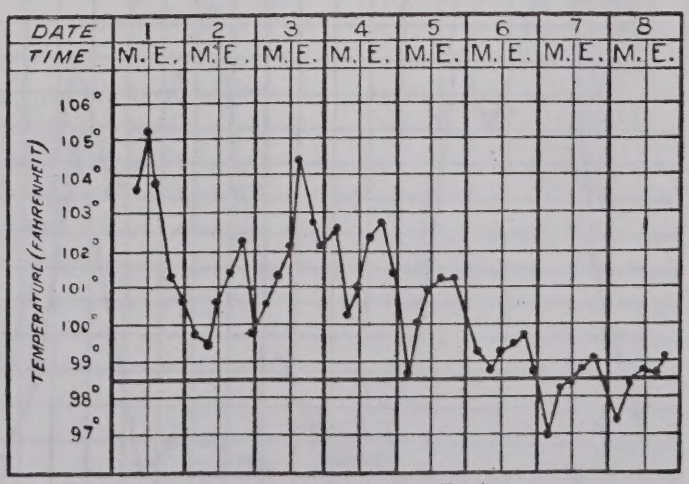
QUARTAN.—Double Infection.

CHART XI.

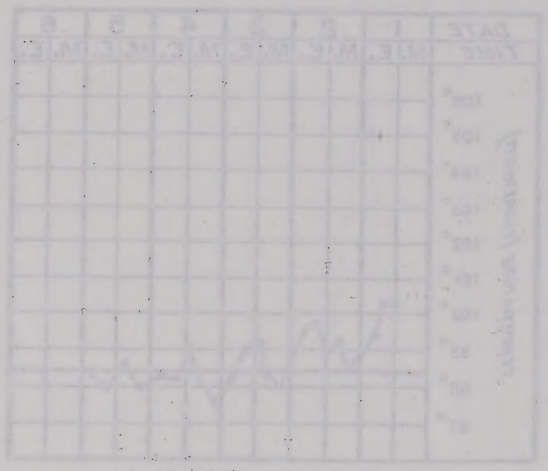


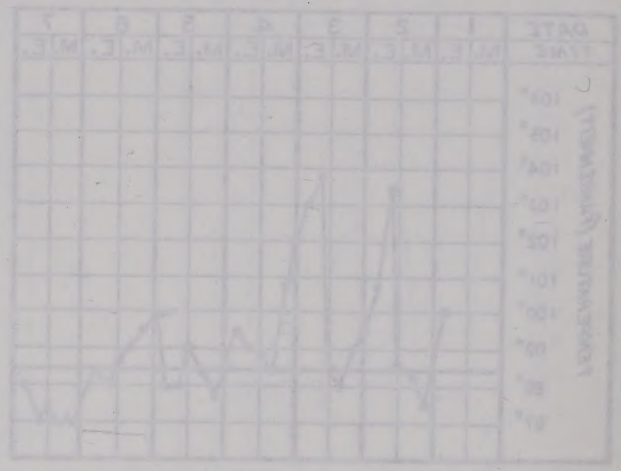
REMITTENT MALARIA.—Benign Tertian type.

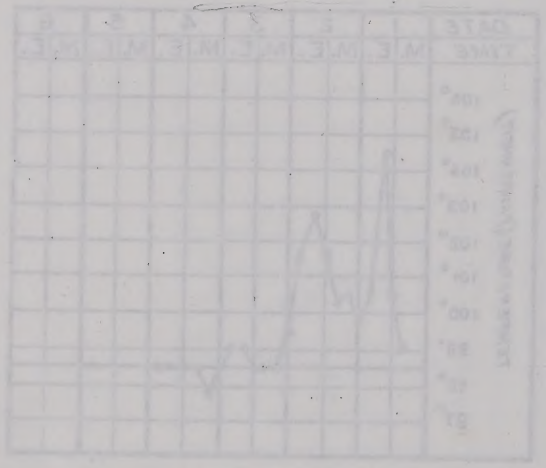
CHART XII.

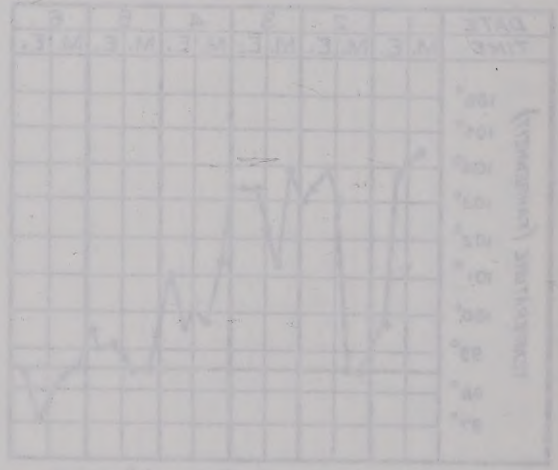


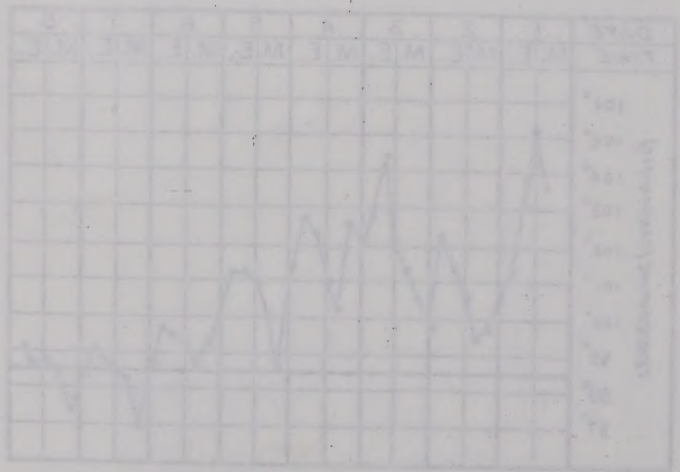
REMITTENT MALARIA.—Malignant Tertian type.

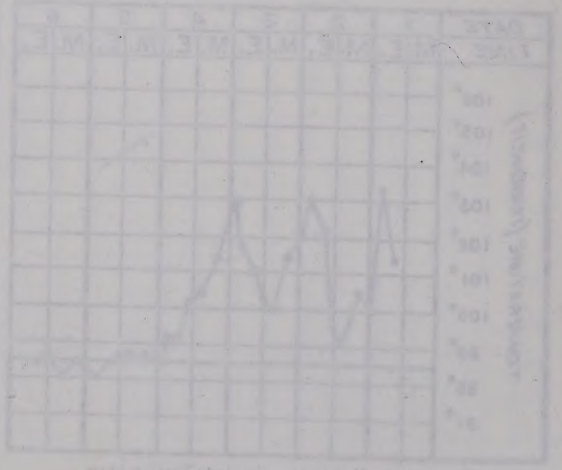












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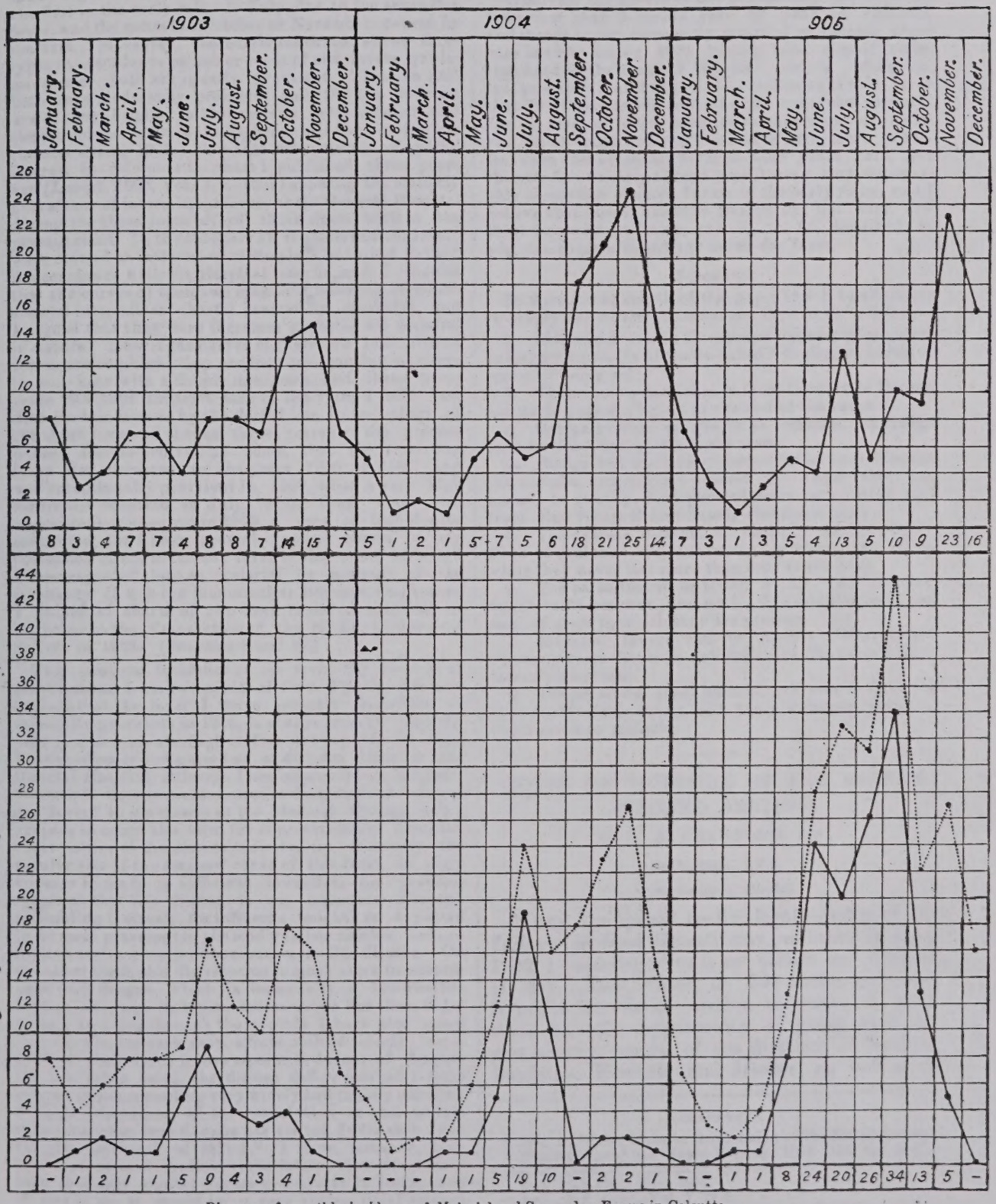
1903
1904
905
January. February. March. April. May. June. July. August. September. October. November. December.
Malarial Fevers.
Combined curve of seven-day and Malarial Fevers
Seven-day Influenza-like fever
8 3 4 7 7 4 8 8 7 14 15 7
5 1 2 1 5 7 5 6 18 21 25 14
7 3 1 3 5 4 13 5 10 9 23 16
- 1 2 1 1 5 9 4 3 4 1 -
- - - 1 1 5 19 10 - 2 2 1
- - 1 1 8 24 20 26 34 13 5 -

Diagram of monthly incidence of Malarial and Seven-day Fevers in Calcutta.

but again it fell rapidly just as the malarial curve went up to its maximum.

Coming next to the combined curve of the two diseases shown in the broken line, we see how the two fevers taken together form a single curve with two maxima, the first in the early rains in July, due to the seven-day fever, and the second in October or November caused by malaria. Moreover, the combined curve shows three types in accordance as one or other of the fevers predominates or both are equally prevalent. Thus in 1903 both were moderately prevalent and the two maxima are of equal height; in 1904 malaria predominated and the second maximum is the higher, while the reverse was the case during 1905. Now this last point is of special interest in reference to chart I published three years ago (*Lancet*, 1903, Vol. I, p. 1502) showing the monthly prevalence of intermittent fevers at the General Hospital during the three years before those dealt with in the present chart. In the old chart all the intermittent fevers were classed as malarial or "Simple Continued Fever" in accordance with the Hospital returns, and I showed that the curves of these two classes of fever (all of which showed intermittent charts) practically coincided, and I argued that they were therefore probably all malarial in nature. Now if the curves of these two intermittent fevers are combined they produce one continuous curve in each year with a double minimum, and these three years 1900-1902 illustrate each of the types I have just described as formed by the dotted line in the chart of the short fevers of the last three years in the present paper. I therefore feel no doubt that the seven-day fever also occurred in the years 1900 to 1902, and was exceptionally prevalent in 1900, when a very high maximum occurred in July, while they were also undoubtedly numerous in 1903, a year of high double maximum, for I have several typical charts in my possession of the seven-day fever of that year, although I then regarded them as malarial on account of the frequency of a large mononuclear increase, and indeed I published charts of two such cases as malarial in my paper in the Transaction of the Medico-Chirurgical Society of 1903. (See cases 8 and 10.)

This seasonal incidence of the seven-day fever is of great interest from two points of view. Firstly, it is now evident that the fever I have recently described, as unusually prevalent in 1905, is always present year by year in Calcutta, although it does not appear to have been previously recognised as a distinct fever at the General Hospital, although I am informed that Surgeon General G. Bomford, I.M.S., used to describe it as "seven-day fever" to his classes at the Medical College, and I propose to adopt this term for it provisionally until the exact nature of the disease is cleared up. Secondly, the regular rise of the seasonal curve of this fever in July appears to me to be sufficient to confirm my previous suspicion that this disease is not influenza, although resembling it closely, for influenza might be expected to be more prevalent in the cold weather months, and not to have such a peculiar distribution as this disease. On the other hand, this distribution is much more in accordance with dengue, which is essentially a hot-weather disease, although its typical course shows but three days' fever. In going through the records I have also noted that the disease each year affects sailors chiefly, especially at first, which is also a point in favour of dengue. On the other hand, the disease differs markedly from dengue in not spreading very widely and rapidly affecting a large proportion of the population as on several occasions when true dengue has visited India such as in the great outbreak of 1871-2.[10] I have, however, been told by several medical men lately that they have seen precisely similar fevers up-country in India, and if this is so, it would be a very strong point against the disease being dengue, as that affection spreads inland with very great difficulty. I shall be very glad to hear from any medical men who can give me information on this point, and in the meantime I am more inclined than ever to look on the seven-day fever as distinct from any known disease, but hope the present year will enable the matter to be cleared up. Whether the bacillus I have cultivated from the blood of several cases is the cause of the disease I am not certain without further experience.

Whatever the nature of the disease may be, it is at least clear that it occurs year by year in Calcutta, and that it is very commonly returned as malaria, every case but two during 1904 having been classed under that head in the General Hospital records. Moreover, it is probably that it was to the occurrence of this fever that Dr. Crombie referred when he wrote that seventy-five per cent. of fevers returned as ague were not malarial, for although malarial cases have been more prevalent than the seven-day fever in most years here, yet the new fever nearly always constitutes a very considerable proportion of short fevers in the early rains, and I believe that now it has been cleared up, but very few short intermittent fevers remain to be described in addition to malaria and the seven-day fever.

SUMMARY.

In view of the length of this paper it will be advisable to briefly summarise the main conclusions as follows:—

1. Malarial fevers in Europeans frequently originate in Calcutta in spite of the so-called "Endemic index of malaria" being *nil*.
2. Their main prevalence is from October to December during the drying up at the end of the rains.
3. Benign tertians are nearly as common as malignant tertians, but quartans are rare.
4. Benign and malignant tertian fevers have distinct and definite temperature curves by which they can usually be readily distinguished from each other and from other fevers if four-hourly charts are kept.
5. The average duration of malarial fevers under 30 to 40 grains of quinine daily is about two days, while they never last more than four to six days.
6. The parasites can be found within two minutes' search in 75 per cent., and within five minutes in 90 per cent. of cases in which they are present.
7. Malarial fevers can be readily differentiated clinically from the seven-day influenza-like fever I have recently described.
8. The seven-day fever occurs every year in Calcutta in the early rainy season and has a different seasonal incidence from malaria.

NOTES ON RUPTURE OF THE SPLEEN (SECOND SERIES).

BY D. G. CRAWFORD, M.B.,

LIEUT.-COL., I.M.S.,

Civil Surgeon, Hughli.

WHEN the special medico-legal number of the *Indian Medical Gazette* was published in June 1902, I contributed to it an article on rupture of the spleen, based on 304 cases, collected from the records of twelve districts. I have since had the opportunity of going over the *post-mortem* reports of the districts of Nadiya, Burdwan, Howrah, and Jessore, as well as of

REFERENCES.

[1] Reports of the Malaria Commission of the Royal Society.
[2] Proceedings of the Royal Society, 1905. On the occurrence of Anopheles Listoni in Calcutta.
[3] *Ind. Med. Gaz.*, Nov. 1905.
[4] *Brit. Med. Jour.*, Vol. I, 1905.
[5] *Jour. Asiatic Society of Bengal*, Vol. 73, Part II.
[6] Scientific Memoirs, No. 19, New Series.
[7] Report on Kala-azar, 1907.
[8] Trans. Med-Chir. Soc., 1903.
[9] *Ind. Med. Gaz.*, Nov. 1902.
[10] Chevers, Diseases of India.

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